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DPT
DEPARTMENT OF PARKING & TRAFFIC
Traffic Engineering Division
City and County of San Francisco
WILLIE LEWIS BROWN, JR., MAYOR
BILL MAHER, EXECUTIVE DIRECTOR

# MEMORANDUM

Date: November 25, 1997

To: Honorable Members
Parking and Traffic Commission

Through: Bill Maher
Executive Director

From: Bond M. Yee
Bureau Chief, Traffic

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Subject: Traffic Calming in San Francisco

At a recent meeting of the Parking and Traffic Commission, DPT staff was asked to brief the Commission on the issue of what is called "traffic calming." This is a newly coined term for a variety of techniques that are intended to reduce the negative influence of motor vehicles on residential streets. San Francisco has experimented with a number of these techniques in the past; various cities around the world are using others. This report provides background about traffic calming in San Francisco, discusses various techniques used by other cities, and presents recommendations for San Francisco.

## BACKGROUND

Traffic calming techniques have been used in various forms throughout the history of the automobile in San Francisco. One of San Francisco's most popular tourist attractions, the crooked street, possesses the physical design elements of one type of modern-day traffic calming technique now known as a "chicane." While the design of the crooked street has succeeded in keeping vehicle speeds down, few would point to the crooked street as a truly successful traffic calming project because of its heavy traffic volumes. The crux of successful traffic calming is therefore two-fold: reduction of vehicle speeds and reduction of vehicle volumes. These are the two most important measures by which all traffic calming techniques should be judged. Closely related to the matter of volume reduction is diversion of traffic. Traffic calming that merely diverts traffic from one street to another cannot be judged as a success.

residential

(415) 554-2300 FAX (415) 554-2352 25 Van Ness Ave., Suite 345 San Francisco, CA 94102-4576

The following is a brief synopsis of the history of traffic calming in San Francisco to date:

STOP Signs

Finding a good solution to speeding has been elusive. Typically, the first instinct of residents is to ask for STOP signs. Unfortunately, this is a poor solution. It leads to rolling stops at intersections, increased mid-block speeds, and reduced service times for MUNI. Some of these side effects lead to secondary safety problems. In the absence of any other traffic calming program, however, the installation of STOP signs is about the only thing that can be done with any demonstrable results.

Speed Bumps

For a time, the City installed speed bumps on San Francisco streets to control speeding. We estimate that speed bumps have been installed on more than 125 blocks in San Francisco. Many of these installations have been removed at the request of local residents. Speed bumps can be noisy and shake nearby houses as vehicles drive over them. Other adverse side effects have been noted, such as vehicles swerving to go around them or actually speeding up to go over the bumps. The City continues to maintain existing bumps when we are assured that the residents want them; otherwise, no new speed bumps are being installed.

Speed Humps

A close cousin to speed bumps is something called a "speed hump." Speed humps do not have the noise and vibration side effects of speed bumps. They are designed with a more gentle rise to avoid those problems. San Francisco has an experimental speed hump located on Kiska Road. To date, we have not recommended a more expansive approach to speed humps because of other controversies associated with them. Instead, we have been monitoring the use of these devices in other cities to learn from their experiences. More discussion about speed humps is included in a later section of this report.

Traffic Circles

Depending on how they are designed, traffic circles can be useful for controlling vehicle speeds. From our experience, we have found that if the circle is large enough to force a driver to make significant turns with his or her steering wheel, then speeds can be reduced. Most recently, traffic circles have been installed at the Dewey Circle and at the intersection of Victoria Street and Urbano Drive. The latter installation was actually done to counteract a problem with traffic "donuts" and several more circles are planned in the same neighborhood. Traffic circles are expensive, however. Small circles with no landscaping cost about $8000 each.

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Traffic Chokers

In the mid-70's, an area-wide traffic calming project was implemented in the Duboce Triangle neighborhood. One of the key features of this project was the installation of traffic chokers at various intersections. Traffic chokers are sidewalk extensions that narrow the roadway. They shorten pedestrian crossing distances and are also intended to reduce vehicle speeds by psychological means. The driver is supposed to feel constricted and adjust his or her speed accordingly. While the theory sounds plausible, our actual experience (and that of other cities using chokers) have found very little reduction in vehicle speeds. (In fact, we have been asked to install more STOP signs in the neighborhood in subsequent years to help with speed control.) Despite this shortcoming, the Duboce Triangle project does appear to be popular with the neighborhood. The project also included the installation of street furniture, more trees, street lighting and angle parking.

Proposition R

Despite the success of the Duboce Triangle project, it was actually the experience of another neighborhood project that would soon afterwards set the direction for traffic calming in San Francisco. That experience occurred in the Inner Richmond District (bounded by Geary Street, Fulton Street, Arguello Boulevard and Park Presidio Boulevard). Although the City held a number of planning meetings to review a variety of traffic calming proposals, it wasn't until the project was being built that the controversy started. So many people complained about the project that the Board of Supervisors decided to put an advisory measure on the 1976 ballot to seek guidance from the electorate. This measure, Proposition "R," read as follows: "Declaration of Policy: Shall the Board of Supervisors adopt the policy of supporting projects requested by residential neighborhood areas throughout the City that are intended to impede the flow of traffic by the use of barriers and other physical means of control?" The vote was resoundingly negative: 75,270 voted "yes" while 124,206 voted "no." With this vote, the idea of other large scale traffic calming projects went dormant. Only smaller scale projects have been implemented since that time.

Cul-De-Sac

Recently, the Commission was exposed to the cul-de-sac technique of traffic calming for Tiffany Avenue. This is the street in the Mission District that was being used as a short-cut by about 4000 vehicles per day. To prevent the short-cut traffic, the Department of Parking and Traffic blocked off Tiffany Avenue at its 29th Street end to create a cul-de-sac. While Tiffany Avenue residents are happy about the reduced traffic on their street, Duncan Street residents are now complaining about the increased traffic on their street. This problem also illustrates one of the negative potentials of traffic calming: traffic can end up on other residential streets.

## TRAFFIC CALMING IN OTHER CITIES

The catalog of traffic calming techniques used in other cities is very similar to what has already been used in San Francisco. The attached Appendix A provides a detailed discussion about these different techniques. The following techniques are discussed:

- STOP Signs
- Speed Humps
- Traffic Circles
- Chokers
- Chicanes
- Channelization
- Turn Prohibitions
- Cul-De-Sac
- Diagonal Diverters
- Semi-Diverters

Rather than repeat the discussion here, please refer to the appendix for illustrations and other information. [One traffic calming strategy not mentioned, unfortunately, is raised crosswalks or speed tables. In actuality, however, these strategies are much like speed humps.] Of all these different traffic calming measures, we would expect that most of the public demand would be for speed humps. For that reason, additional discussion about speed humps is provided below:

### Speed Humps

While speed humps can be successful in reducing vehicle speeds, they also have some drawbacks:

- **Effect on Emergency Vehicle Response Times** Speed humps slow vehicles down to a speed of 15 mph. This would add approximately 10 seconds of delay to an emergency response. With a citywide program of speed humps, this could add substantial delay to an emergency response call.

- **Effect on Public Transit** MUNI is concerned about potential liability in driving their buses over MUNI routes. Standing passengers may fall as the bus goes over a hump.

- **Proliferation** People complain about speeding on practically every street in San Francisco. Even with strict guidelines for the installation of speed humps, the emotional nature of speeding complaints may cause the best intentioned guidelines to be overridden.

- **Expense** The City of Oakland estimates the cost of speed humps at approximately $2900 for a set of two per block. Other cities have reported a cost of about $2000 per hump.

- **Unusual Medical Conditions** We have received correspondence about how speed humps

can be painful to traverse for people with certain medical conditions (spinal deformities, women at risk for miscarriages, and people with significant-to-severe osteoporosis). Ambulance crews can also have trouble administering medical treatment while traveling over speed humps.

We are currently having ongoing discussions at the Interdepartmental Staff Committee on Traffic and Transportation (ISCOTT) about the potential use of speed humps in San Francisco. At this point we still have some unanswered questions.

Speed humps are not the only viable method of speed control. Another interesting technology is photo-radar. While not conventionally considered a traffic calming device, it does offer potential in controlling speeds.

Photo-Radar

Photo-radar is a law enforcement tool that works in similar principal to the City's red light cameras. When a driver exceeds the speed limit, a photograph is taken of the vehicle and a citation is mailed to the registered owner of the vehicle. This technology is in operation in other areas of California as well as in Washington State, Utah, Michigan, Arizona, Florida, and 45 countries around the world. At a recent traffic calming seminar, we learned about the use of the use of photo-radar in two nearby Bay Area communities: Oakland and San Jose.

The City of San Jose found that neighborhoods responded well to their program. Overall traffic speeds were reduced, and most significantly, there was a dramatic reduction in the number of people driving more than 10 mph over the speed limit. They also found a spill-over effect with reduced speeds on other streets in the neighborhood. Furthermore, the local residents did not notice a shifting of travel patterns within the neighborhood. The only significant problem encountered by San Jose is related to the cost of the program. State legislative reform is needed to increase the level of revenues going to cities.

## RECOMMENDATIONS

In general, it is best to consider traffic calming from an area-wide standpoint. Traffic calming that merely shifts traffic from one residential street to another is unacceptable. Along these lines, DPT staff recommends the following criteria for a traffic calming strategy:

- No diversion of traffic from one residential street to another residential street
- Reduction of unsafe speeds
- No significant effect on MUNI operations
- No significant effect on emergency vehicle response times
- Neighborhood satisfaction
- Affordable

Based on this criteria, we believe that photo-radar comes closest to meeting this criteria. However, questions about whether or not such a strategy can pay for itself must be answered. We will pursue these questions when our new Red Light Camera engineer begins working for our Department.

As for speed humps, we realize that there is a public demand for them. However, we cannot give speed humps an unqualified endorsement. We would expect a tremendous demand for them, which could end up affecting citywide mobility and emergency vehicle response times. Embarking on such a program would be costly. If the Commission wishes to pursue a speed hump program, we would recommend a plebiscite on such a program. This plebiscite should contain the following elements: (a) a mechanism to fund speed hump installations, such as a general obligation bond, and (b) strict, unalterable criteria on where speed humps can be installed. However, before we reach the point of making a recommendation on a referendum, we want to finish our discussions with other city departments on this issue. At that point, we can make further recommendations to the Commission.

In the meantime, DPT staff will continue to recommend various smaller scale traffic calming projects, such as circles, as funding becomes available. In the next year, for example, we plan to install at least three new traffic circles. We are also still in the process of making recommendations about street closures, such as on Tiffany Avenue. We will also continue to make recommendations for other traffic regulation changes (STOP signs, one-way streets, and turn restrictions) to reduce the impacts of neighborhood traffic. We intend to recommend projects only after the areawide consequences have been thoroughly considered.

Beyond this, there is the much larger issue of reducing automobile traffic demand in general. There are a multitude of actions that can be taken to discourage automobile traffic and encourage the use of other modes of transportation. The Commission on San Francisco's Environment developed "The Sustainability Plan for the City of San Francisco" to address transportation issues amongst a host of other issues. This plan has a number of specific transportation recommendations, which are included as Appendix B. Rather than repeat these here, the Commission is referred to the Appendix to consider the various ideas. Many of these ideas are currently being implemented.

# APPENDIX A

# City of Oakland
# Neighborhood Traffic Controls
# Guidebook

July, 1995

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## PREFACE

Everyone would like to live on a quiet street where there is little traffic and all motorists drive slowly. But the fact is we all must share our streets with our neighbors and other people. Just as we need to drive by other people's houses on other streets on our way to work, school or shopping, other people need to use our street to get to work, school or shopping.

It is the City of Oakland's policy to make residential streets as quiet and safe as possible, but these streets must still provide access for people and jobs in the city. The traffic control measures in this booklet are designed to slow down traffic and discourage through traffic on residential streets, while keeping our neighborhoods accessible to police, fire, ambulance services and the residents of Oakland. Some of the controls are quite expensive, therefore, the City can only install a few of these in key locations. Other controls are relatively inexpensive and can be installed in many places. Most of the controls shown here, however, don't work well on non-residential streets, where through traffic volumes and speeds are high.

We encourage you to go through this booklet and learn about the neighborhood traffic controls we have available to help slow down and reduce traffic on residential streets. You can also do your part to help solve neighborhood traffic problems by driving carefully and at reasonable speeds on our streets.

Feel free to call us at (510) 238-3466 if you have any questions.

Sincerely,

City of Oakland
Traffic Engineering Division

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GLOSSARY

# INTRODUCTION

## *Character of Neighborhood Traffic Controls*

Neighborhood traffic controls are an attempt to enhance traffic and pedestrian safety and preserve neighborhood character and livability. Each device has its own characteristic effects on traffic flow; similar devices can be more or less effective depending on particular site details. Primary effects produced by these controls fall into the broad categories of speed reduction, traffic volume reduction, increased driver awareness, and increased safety.

Success of these controls depends on their use in locations and situations for which they are most effective. When appropriately implemented they tend to be self-enforcing and the intended effect on traffic is achieved. When implemented inappropriately, they tend to be excessively violated, unless aggressive enforcement efforts are made. The City's enforcement resources are always in high demand, and it can not be assumed that there will be resources available to provide aggressive enforcement of new traffic controls.

These controls are intended for use on neighborhood streets which are not designated in the General Plan for arterial or collector circulation purposes. While some of these measures are also used on arterial and major collector streets, most are not appropriate for such use. The purposes and standards for traffic controls used for neighborhood traffic control and management are typically different than those used for arterial and major collector street traffic control. In the neighborhood setting, reduction of speed and traffic volume are the priorities. On arterials and major collectors, the priority is typically the efficient and safe movement of through traffic during peak hours.

## *Purposes of this Guidebook*

This guidebook is intended to provide the public with information which will be helpful in identifying appropriate traffic control measures to address neighborhood traffic problems. It illustrates the types of traffic management measures that can be used to control traffic on residential streets in the City of Oakland. It identifies the types of traffic concerns each measure addresses. It sets forth the conditions which need to exist before each measure is considered for implementation. Additionally, it identifies specific factors which may favor or disfavor use of a given measure at a particular location or for a certain purpose.

A frequent subject of community concern on local residential streets (and on busier residential arterial and collectors where the controls presented in this guidebook can not be used) is excessive traffic speed. An appropriate compliment to the deterrents presented in this guidebook is speed enforcement by police. There are a number of advanced techniques of speed enforcement which might have useful application; however, discussion of these is beyond the scope of this guidebook.

The drawings, photos, and sketches in this guidebook are for purposes of illustrating the concepts involved; they do not constitute engineering design recommended for any specific location in Oakland. Applications at each individual site must be carefully designed by a competent engineering professional.

Oakland and other communities are always looking for better measures for controlling traffic on residential streets. Some measures being used elsewhere are still in the experimental stage and consequently are not included in this guidebook. Any such measures which prove to be appropriate and effective for use in residential street settings may be considered for use in the future. Those illustrated in this guidebook are the full range of controls currently considered appropriate for use in the City of Oakland.

***Related Criteria and Policies***

There are several related criteria and policies of the City of Oakland and the State of California which provide a framework for the design, implementation, operation, and enforcement of traffic controls. These criteria and policies need to be considered when planning and developing neighborhood traffic control installations. Among these are the following:

*Prioritization methodology* - the City's policies and methodology for prioritizing the installation of needed controls within prevailing budgetary constraints will affect the timing of implementation.

*Street development and operation standards* - the City's street improvement and operational standards will affect the design and installation of individual measures.

*Traffic Manual (Caltrans)* - the design and usage of all traffic control measures within the State of California are affected by the roadway development and roadway operation practices contained in this manual. Deviations from these practices are unusual and must recognize the potential for problems arising from driver confusion produced by non-standard devices or installations.

*Enforcement programs and resources* - the City's traffic law enforcement programs and resources will affect the success of some installations which may need aggressive enforcement efforts to be effective.

## STOP SIGNS

***Description:*** A regulatory sign placed at intersections which requires drivers to come to a complete stop and assure that it is safe to proceed under the normal right of way rules before proceeding into the intersection.

***Objective:*** Control of right of way at intersections where there is reason to believe that the intersection does or would not operate within reasonable safety expectations if left to operate as an uncontrolled intersection under the general right of way law. Often this is because of factors which obstruct sight distance for vehicles entering the intersection from conflicting approaches.

***Neighborhood Traffic Applications:*** Residents often desire STOP signs as a remedy for perceived collision or pedestrian crossing dangers at intersections, as a traffic diversion device, or for speed control. Requests for neighborhood applications frequently become controversial for two reasons. First, traffic engineering practice normally requires objective evidence of need for right of way control, rather than just the perception of danger. Second, the use of STOP signs for diversion or speed control is contrary to traffic engineering evidence and opinion, which argues such STOP applications are ineffective for those purposes.

***Prerequisites, Limitations & Constraints:*** Warrants for STOP signs defined in the California Department of Transportation *Traffic Manual* should be followed at all intersections on streets designated arterials and major collectors. These warrants are incorporated into this guidebook by reference.

Numerous California communities have found that the warrants in the *Traffic Manual* tend to emphasize the traffic flow function of arterial and major collector streets, and are unresponsive to the needs on residential streets. The following warrants, patterned after ones in use in other Bay Area communities, are to be used in evaluating appropriateness of STOP signs at residential intersections of local access streets or minor collectors with other local access streets.

The warrants for installation of all-way stop signs on residential collectors or minor residential streets are satisfied if the following conditions exist: The major (busier) street approach volume is at least 2,000 vehicles per day, and the minor street approach volume is at least 900 vehicles per day, and at least one of the following conditions exist:

1. When 20 or more elementary school children use the intersection going to or from school at a time when at least 300 vehicles are in direct conflict with pedestrians;

2. When 20 or more elementary school children use the intersection at a time when the 85th percentile speed is at least 10 mph higher than the posted speed limit, and lower speeds at the intersection are necessary for pedestrian protection;

3. When the 8-hour approach volume (total of both approaches) on the minor street is greater than 30% of the total 8-hour approach volume for all approaches, and the total 8-hour approach volume for all approaches averages at least 250 vehicles per hour;

4. When 3 or more accidents of types correctable by all-way stop control have occurred within a recent 12-month period.

***Advantages/Other Considerations:*** Readily understood. Can be installed quickly and inexpensively. Ineffective as speed control device except within 200 feet of intersection (where it also has the undesired effect of increasing traffic noise). May have some effect on midblock speeds of the very fastest drivers, while not affecting midblock speeds of the vast majority of drivers. Ineffective as a traffic diversion device except where travel time using the short-cut route through the neighborhood offers only a small advantage over the travel time using the more appropriate route.

***Alternate Devices:*** For right of way control: yield sign, traffic signal, occasionally circles. For speed control: traffic circle, undulations, enforcement preferable. Diverters, semi-diverters, cul-de-sacs, median barriers, turn prohibitions and channelizations are preferable as diversion devices.

***Cost (Typical):*** $500 per intersection for 2-way STOP; $1000 per intersection for 4-way.

## Stop Signs

**Figure 1**
**"Stop" and "Stop Ahead" Signs Are Readily Understood and Easy to Install but, They Must be Warrented If They Are to be Effective.**

## UNDULATIONS (SPEED HUMPS)

*Description:* Gradual rise and fall in pavement surface, generally to a maximum height of 3 inches in a circular arc projected over a 12 foot chord in the direction of travel. Creates an undulation (variation) or hump in the the roadway surface.

*Objective:* Reduce vehicle speed.

*Specific Applications:* Used on local access streets experiencing significant speed problems. Possibly justified if 85th percentile speed exceeds 30 mph, or 50 percent of vehicles exceed posted limit, or the average speed of top 15 percentile of vehicles exceeds 35 mph.

*Prerequisites, Limitations & Constraints:* Street must have 25 mph speed limit. Street cannot be classified arterial or collector or have more than two travel lanes. Street cannot be a principal emergency vehicle route, public transit route or truck route. Undulations should not be placed on blocks serving as primary access route to significant truck traffic generator, even if not designated as truck route.

They cannot be placed on grades exceeding 5 percent, at points within 200 feet of intersections or where horizontal and/or vertical alignment limits sight distance to less than 200 feet. Also, cannot be placed within 20 feet of driveways; within 25 feet of fire hydrants, or over manholes, utility valves or street monumentation.

When feasible, they should be located to take advantage of existing street lighting fixtures on or close to property lines or to take advantage of side-lot frontages.

Prior to consideration, representatives (owners or occupants) of 67 percent of the properties with front or side frontage on the block in question must sign a petition favoring the installation.

*Advantages/Other Considerations:* Highly effective, modest cost, self-enforcing. Undulations may produce minor traffic diversions. Recognized as different from common "speed bumps" which are regarded as ineffective and unsafe for use in the public right-of-way. Some jurisdictions are using undulations with profiles longer than 12 feet in the direction of travel (most commonly 20 feet) in efforts to lessen the severity of effect on long wheelbase vehicles or to make the undulations more appropriate to driver expectations of travel along urban streets.

*Alternate Devices/Strategies:* Circles, curb bulbs, serpentine, enforcement.

*Cost (Typical):* $2,900 per block (usually 2 undulations per block).

# Undulations

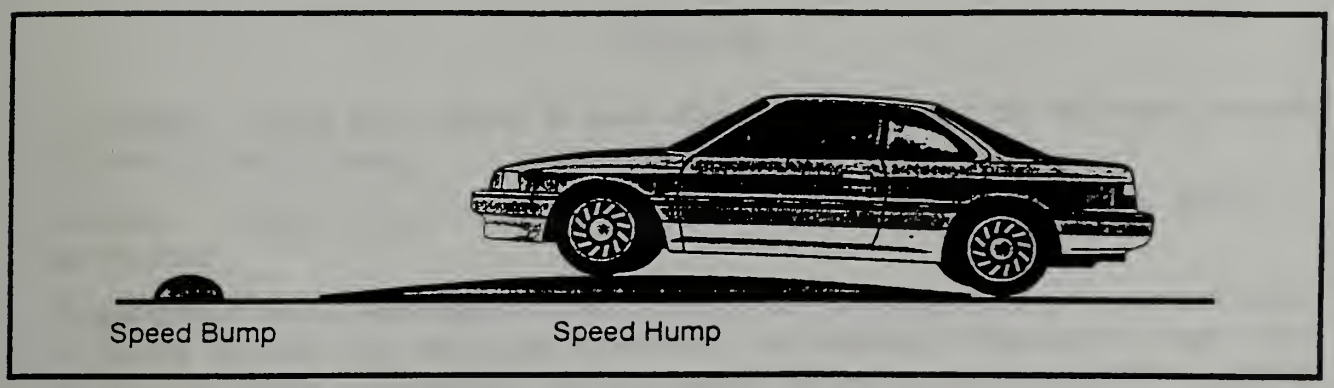



**Figure 2a - The Difference between a "Common Speed Bump" and a "Speed Hump."**

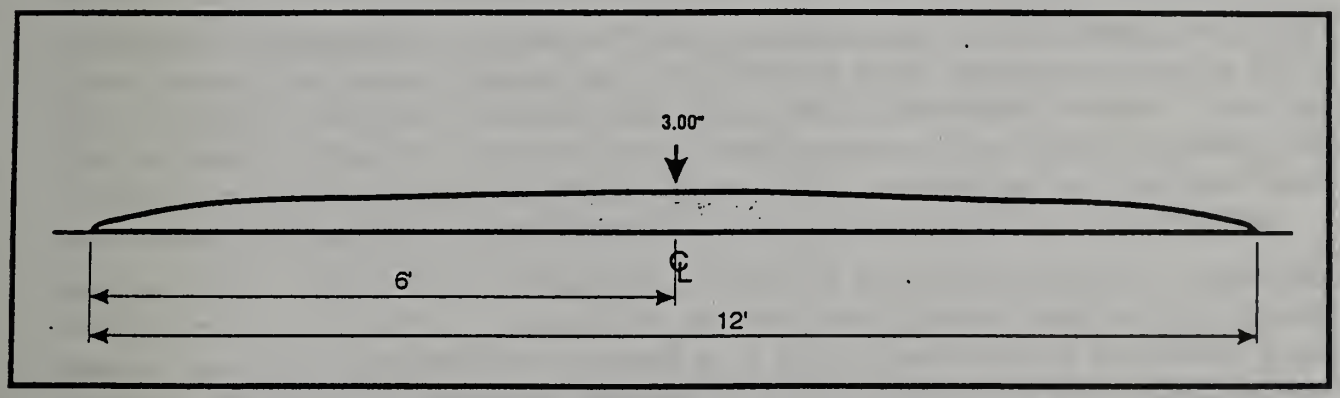
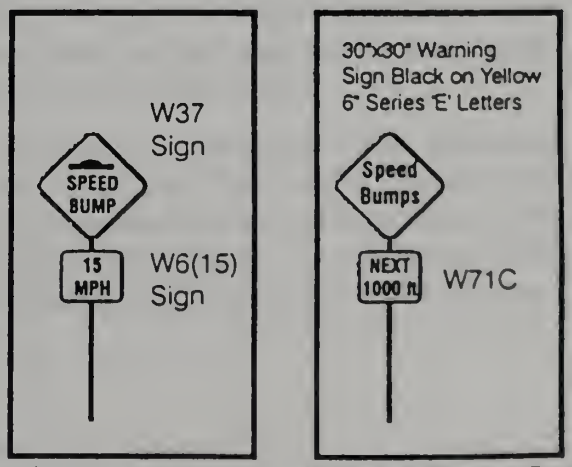



**Figure 2b - Typical Undulation Dimensions.**

**Figure 2c - Typical Oakland Installation.**




*Adjacent to Undulation.* *Advanced Warning Sign (where appropriate).*

**Figure 2d - Warning Signs.**

## CIRCLES

*Description:* Raised islands placed in the middle of an intersection; not necessarily precisely centered or exactly circular.

*Objective:* Reduce speed. Increase safety by establishing predictable flow patterns at intersections.

*Neighborhood Traffic Applications:* Used at intersections on streets where more restrictive speed or volume measures (like undulations, cul-de-sacs) are undesired or inapplicable; where speed problems are focused at intersections; or where unusual intersection geometry and excess traveled-way surface creates unpredictable flow patterns and conflict points. Generally much smaller than the circles (rotaries or roundabouts) used on major streets and highways as an alternative to signals or interchanges, but larger, with more vertical massing, than "mini-roundabouts" (often just a painted dot) used in local street situations in Europe as an alternative to STOP and YIELD signs.

*Prerequisites, Limitations & Constraints:* Used for speed control on local access streets only. Speed control effect on most vehicles only within 200 feet of the intersection (similar to STOP signs), although circles have a midblock speed control effect on the fastest vehicles. Circles are best used where the desire is to control speed near intersections or to affect midblock speeds of the fastest vehicles, rather than speeds of average drivers. Effects on speed may be intensified if used at a sequence of intersections or in combination with other devices to create a cumulative effect.

Size and specific shape must be customized to individual intersection geometry. Intersecting streets normally must both be in excess of 30 feet curbface-to-curbface width to allow adequate space for the circle and traffic lanes. Requires good sight distance and level to moderate grade conditions. Middle of the intersection positioning gives rise to the need for good visibility across-the circle and makes circles susceptible to being struck by errant traffic. High-visibility materials, reflective signs and markings, and mountable materials should be used. These requirements limit the opportunities for landscaping the circles.

May require reconstruction/relocation of manholes, utility valves, and street monumentation. Less effect on emergency vehicles and regularly routed and unrouted services than undulations, cul-de-sacs or diverters. May be used when such considerations preclude other devices.

*Advantages/Other Considerations:* Tend to reduce accidents at intersections. May necessitate parking limitations on intersection approaches. May cause anxiety or direct conflict for bicyclists and pedestrians by forcing motor vehicle trajectories through intersection and on approaches closer to crosswalks and to trajectories normally selected by bicyclists. Rarely if ever causes traffic diversion; diversion effects may occur if used in combination with diversion-oriented devices. May be used on routes where diversion is inappropriate.

*Alternate Devices:* Undulations, curb bulbs, chicanes.

*Cost (Typical):* $8,000 hardscaped; $12,000 landscaped.

# Circles

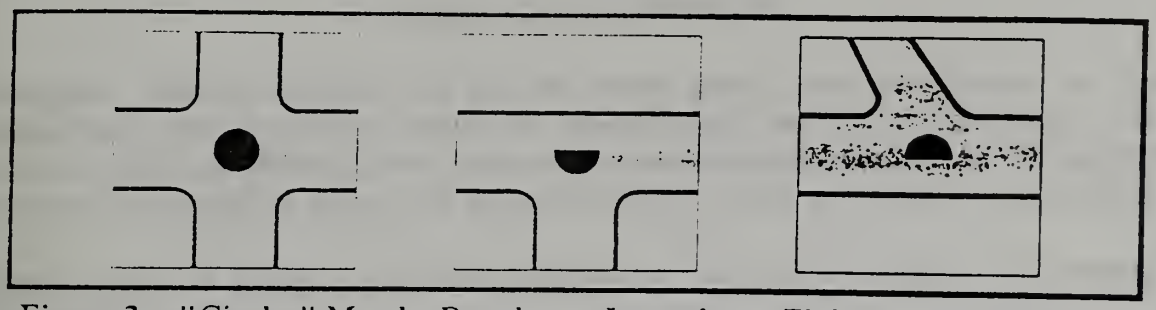


Figure 3a -"Circles" May be Regular or Irregular to Fit Intersection Geometry.

**Figure 3b**
**Gracefully Landscaped Circles Enhance Neighborhoods & Gain Driver Respect.**

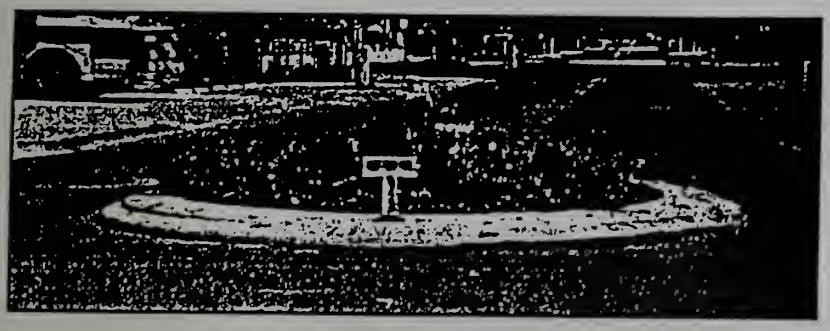


**Figure 3c**
**Circles with Low Massing & Marginal Landscape are Subject to Runovers.**

**Figure 3d**
**Hardscape Circles Need Substantial Vertical Massing to Discourage Overruns.**

## CURB BULBS (CHOKERS)

*Description:* Extension of the curb into the former paved street area (backed by sidewalk, landscape and other features) to narrow the street traveled way at intersections and other key locations. These are different from the semi-diverters discussed elsewhere in this guidebook in that they do not extend far enough into the street to block a traffic lane (as do the semi-diverters).

*Objective:* Enhance pedestrian safety and traffic safety, slow traffic, increase traffic awareness of neighborhood environment.

*Neighborhood Traffic Applications:* Best used at intersections where there is intent to reduce the exposure distance of crosswalks and to place pedestrians at a better driver-pedestrian sight line before pedestrians leave the curb. Used for speed control as integral component of chicane devices. Used to control speed by creating sense of narrowness. Used to give visual cue to drivers of transition from arterial-collector environment to local access neighborhood environment.

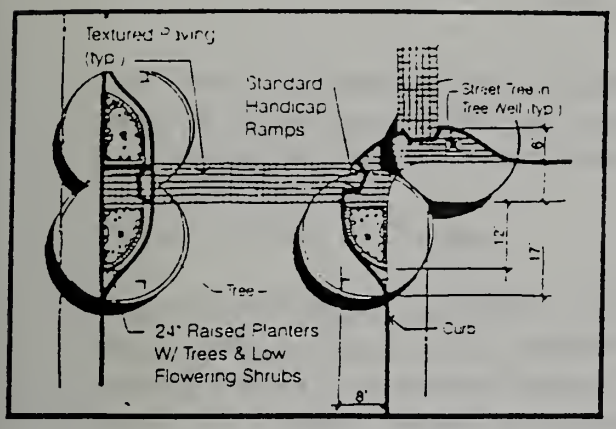
*Prerequisites, Limitations & Constraints:* Cannot be used on streets of less than 22 feet traveled way width, or to narrow the traveled way to less than 22 feet (2-way), or to narrow individual lane width to less than 11 feet. Additional traveled way width is necessary on streets with bike routes or bike lanes (use generally inappropriate on such streets). Its use to create radical narrowings - in effect creating a short one-lane section of street to be used in turn by traffic in both directions - is not appropriate. Design must respect turn radius requirements for common vehicles and gutter flow and drainage inlet requirements. May require relocation/adjustment of utility valves and manholes.

*Advantages/Other Considerations:* May include landscape/urban design features to create "gateway" treatment. May be useful on streets where sideswipe of parked vehicles is a problem. Can be used in staggered configuration to create chicane effect and used at midblock as well as intersection corners to create portal effects.

*Alternate Devices:* Undulations, circles.

*Cost (Typical):* Per pair: $3000 hardscaped; $5000 landscaped.

# Curb Bulbs



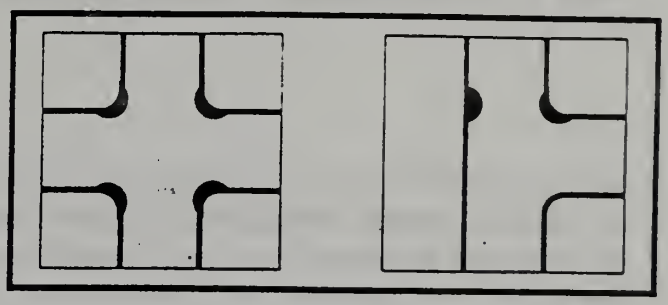



**Figure 4a - At Intersection, Most Often Used to Create "Entry or Gateway Effect."**

**Figure 4b - Staggered at Midblock to Create a Chicane Effect. Planting Heavily Protected by Concrete Planter.**

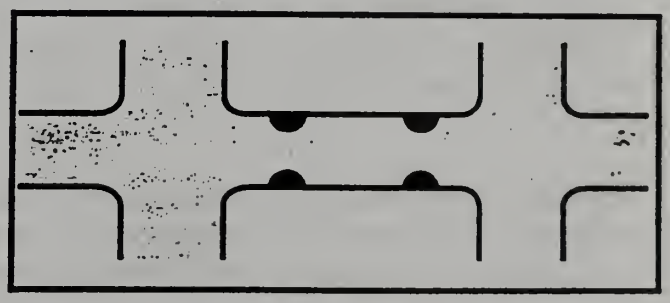


**Figure 4c - Paired at Midblock to Create 'Slow Point' Where Opposed Drivers Must Defer to One Another.**

**Figure 4d - Objective of bulbs & Chicanes is to Create Sense of Narrowness so Opposed Motorists Need to Defer to One Another.**

## CHICANES (SERPENTINE)

*Description:* Creation of artificial sinuousness or S-curvature on a naturally straight road by means of curved centerline striping, juxtaposed curb bulbs and/or juxtaposed curb parking areas, or by varying the shape of median islands.

*Objective:* Reduce traffic speed.

*Neighborhood Traffic Applications:* Useful where straight unbroken vista of streetscape invites excess speed or where actual transition in street functional classification and/or transition in abutting land use is not evident in drivers'-eye-view of street. Severity of the device can be varied from mild curvature, tending to increase driver consciousness of the situation, to more severe configuration, actually imposing some physical constraint on operations. In more severe configurations (rare), creates a situation commonly occurring on narrower residential streets, where juxtaposition of parked vehicles create one-lane sections used bi-directionally, forcing opposed-direction motorists to slow down and make accommodation for one-another.

*Prerequisites, Limitations & Constraints:* Severe configurations are only used on low volume, 25 mph local access streets; liability implications of severe configurations are unresolved. Milder configurations may be useful on 30 or 35 mph streets and, in special circumstances, may be useful on collectors or junior arterials. Where used in concert with devices such as undulations, the criteria for application of those devices controls.

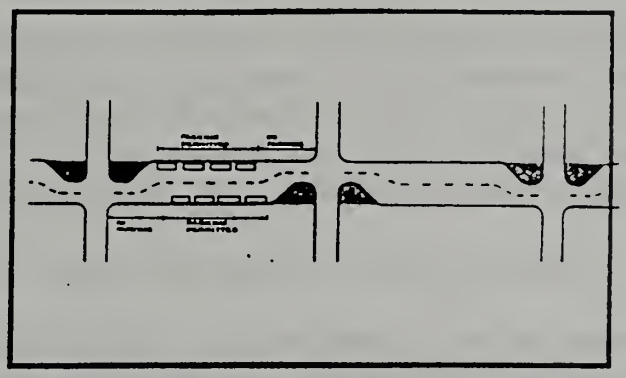
Requires good sight distance characteristics - at least 200 feet sight distance to the first curve and a continuous vista to several oscillations of the curve. Not acceptable or effective on segments of streets with substantial horizontal curvature or where crest vertical curves limit sight distance.

*Advantages/Other Considerations:* Mild chicanes may be used on streets where emergency service considerations preclude more physically restrictive devices. To be effective, may require multi-block treatment where blocks are short.

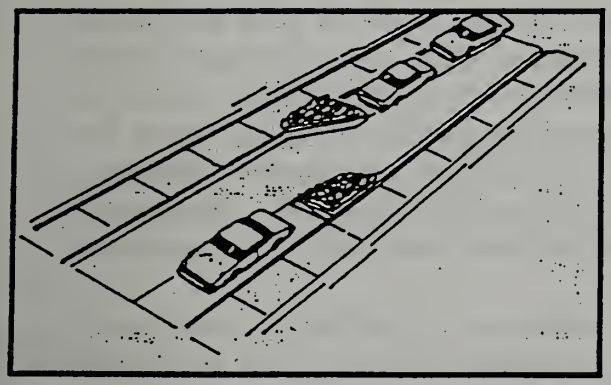
*Alternate Devices:* Undulations.

*Cost (Typical):* Varies substantially depending on length and construction materials.

# Chicanes

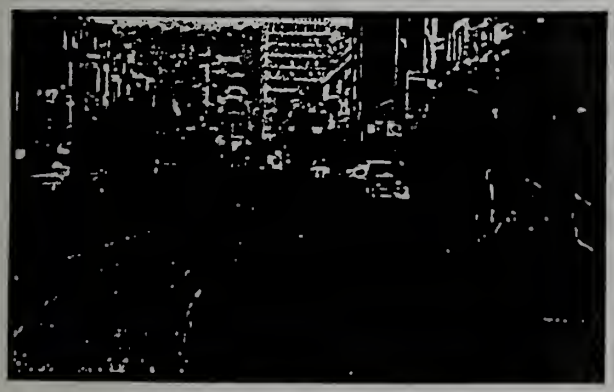


(a) Chicanes with Intersection Curb Bulbs.



(b) Chicane with Midblock Curb Bulbs and Offset Parking.

(c) Application in Berkeley, CA in Combination with Speed Hump



(d) Using Planter Bollards.

(e) Serpentine Curb Line.

**Figure 5 - Chichanes with Intersection Curb Bulbs.**

## CHANNELIZATION & MEDIAN ISLANDS

***Description:*** Channelization involves the use of raised islands (includes curb, gutter, landscape or hardscape and other design features) at intersection approaches or within intersections to force traffic to make or forego certain movements. Median islands are raised islands along the centerline of one street, continuous through intersections with cross streets, or (less frequently) between intersections on a given street to occupy excess traveled-way space.

***Objective:*** Reduce traffic volume or, infrequently, reduce traffic speed.

***Neighborhood Traffic Applications:*** Channelization is used to discourage through traffic by eliminating certain through and turn movement opportunities; used when more severe restraining devices like cul-de-sac's and diagonal diverters are inappropriate.

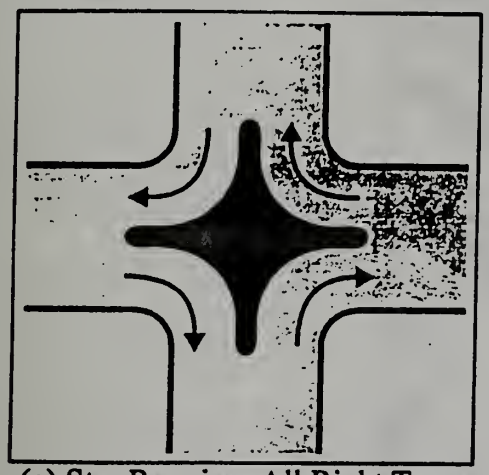
Median islands, in the more common volume control application, are used to prevent through traffic flows along a local access street from crossing an arterial or collector boundary from one neighborhood to the next and/or to prevent certain turn movements between the arterial/collector and the local access street. In the considerably less common speed control applications, the intent is to reduce speed by reducing excess traveled-way width (alternative to curb bulbs) or, as the fundamental element of a chicane, to give artificial sinuousness to the street by using a varying cross-section. Median islands are also used for purposes of improved flow and improved operational safety along major streets and highways.

***Prerequisites, Limitations & Constraints:*** Channelization can be placed on local access streets at intersections with collectors or arterials or at intersections of two local access streets; can also be placed on collectors or arterials but only to affect movements to/from local access streets, not through movements along the collectors or arterials themselves. Best if used at arterial/collector perimeters of neighborhoods, but also effective if used in internal locations. Normally combined with regulatory signs (such as RIGHT TURN ONLY, NO LEFT TURN, etc.). Requires adequate sight distance and absence of severe grades or awkward geometric conditions.

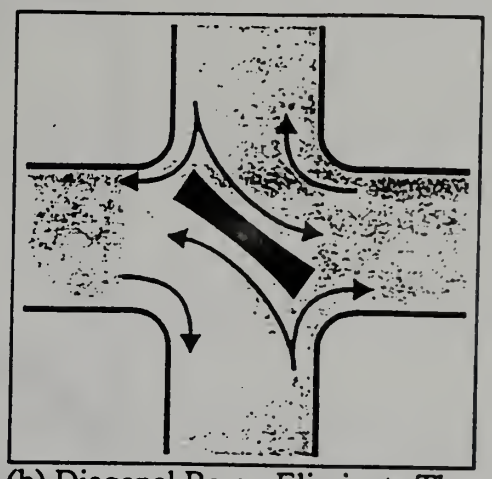
As volume control, median islands are normally placed on arterial or major collector through intersections with local access streets. Might possibly be feasible to place through the intersection of two local access streets. As speed control, they are only placed on local access streets or possibly minor collectors. Can be used along, but cannot be placed across, public transit routes.

Design details of median islands must include provision for special emergency vehicle passages at key locations. Maintenance of reasonable local access patterns must be assured (some partial limitations of prior access may reasonably occur). It may be possible to "soften" the effects on local access and local circulation by providing midblock U-turn pockets (if the median is wide enough to accommodate such pockets); this can generally be done without compromising the effect of the device on through traffic. Bicyclist crossings are accommodated by handicapped gaps or ramps at pedestrian crossings.

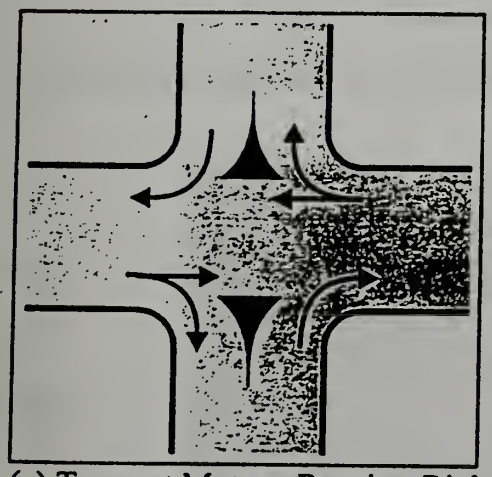
# Channelization



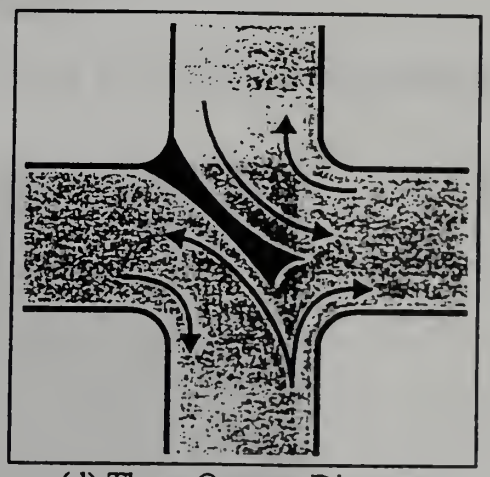
(a) Star Requires All Right Turns.



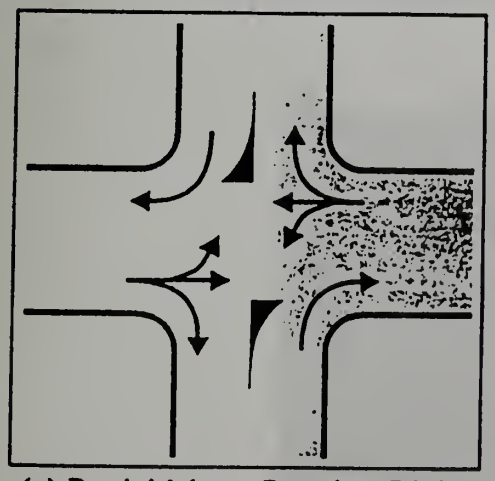
(b) Diagonal Bars - Eliminate Thrus and Some Lefts.



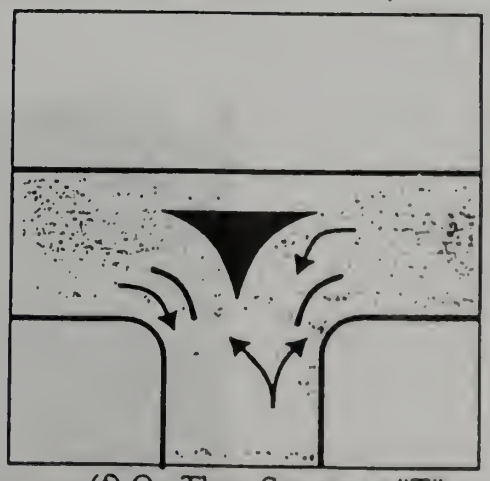
(c) Trumpet Mutes - Requires Right-Turn-Only In & Out on Some Approaches.



(d) Three-Quarter Diverter.



(e) Partial Mutes Requires Right Turns Only on Outbound Movements.



(f) On Thru-Streets at "T".

Figure 7 - Channelization Controls Turning Movements at Intersections.

# Median Island

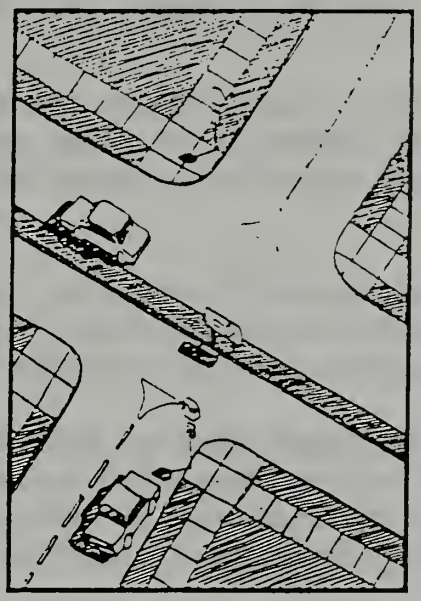


Figure 6a - Median Through Intersection Prevents Thru and Turn Movements

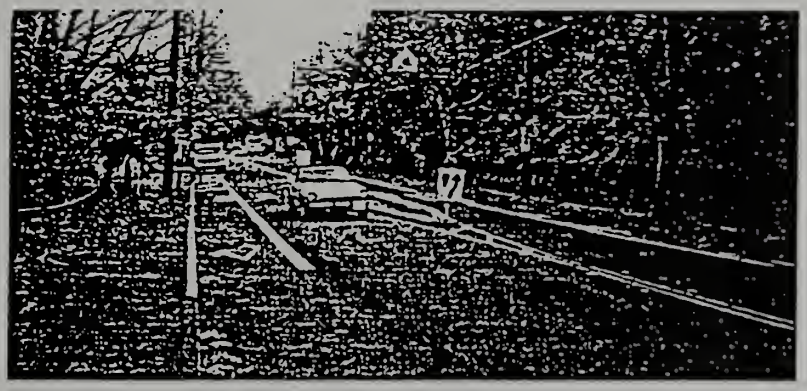


Figure 6b - Median at Midblock Creates "Slow Point"

Figure 6c - Paint Median at Curve Forces Tighter Turns, Slowing Traffic

Adequate physical space for development of the median must be available without compromise to adequate design widths for other street elements (traffic lanes, bike lanes if present, parking shoulders).

Median islands may require reconstruction/relocation of manholes, utility valves or street monumentation; may also require adjustments to drainage and may necessitate provision of additional fire hydrants. May affect regularly routed services such as refuse collection and school transit as well as unrouted services.

***Advantages/Other Considerations:*** Advantages of channelization over simple turn prohibitions include self-enforcing nature of the device and potential for landscape. May require reconstruction or relocation of manholes, utility vaults and similar street features.

Median islands have positive traffic flow and safety implications when placed along arterial and collector streets. Drivers' perception of device as ordinary flow/safety device, rather than special traffic restraint device, is an important positive consideration in communities where driver resentment/reaction to large scale neighborhood traffic restraint programs becomes an issue.

***Alternate Devices:*** Turn prohibitions, cul-de-sacs, diagonal diverters, semi-diverters.

***Cost (Typical):*** Varies substantially.

## TURN PROHIBITIONS

***Description:*** Regulatory signs prohibiting right or left turns or ordering that only a designated turn movement be made.

***Objective:*** Reduce traffic volume

***Neighborhood Traffic Applications:*** Used at arterial/collector perimeter of neighborhood to discourage particular pattern of through movement. Best when used with specific, peak period, time of day limits to target particular patterns of through commute traffic.

***Prerequisites, Limitations & Constraints:*** May be placed on arterials/collectors or on local access streets (though never to obstruct the through movement along arterials/collectors). Especially effective when reinforced by channelization. Used alone without channelization, depends on driver compliance and/or police enforcement for effect. Therefore, most effective when placed at arterial boundaries to neighborhoods; relatively ineffective if placed at locations internal to neighborhoods. Requires adequate sight distance.

***Advantages/Other Considerations:*** Can enhance flow/safety on arterials/collectors. If used without channelization, has little impact on emergency service operations.

***Alternate Devices:*** Channelization, diverters, semi-diverters, median islands, cul-de-sacs.

***Cost (Typical):*** Normally about $500.

# Turn Prohibitions

Figure 8a
This is the International "No Left Turn" Sign. It is a Simple and Effective Control Device.

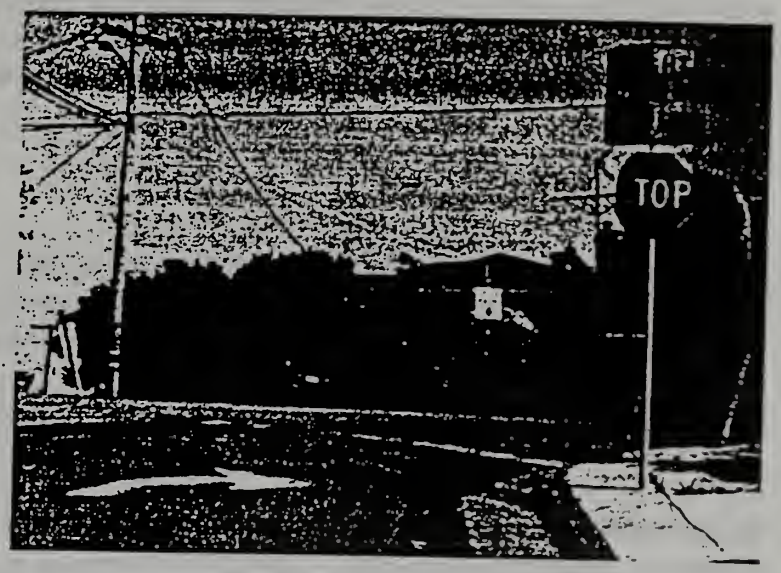



Figure 8b
"Right Turn Only" Sign Allows Access to Local Community While Making this Street a Poor Choice for Thru Traffic.

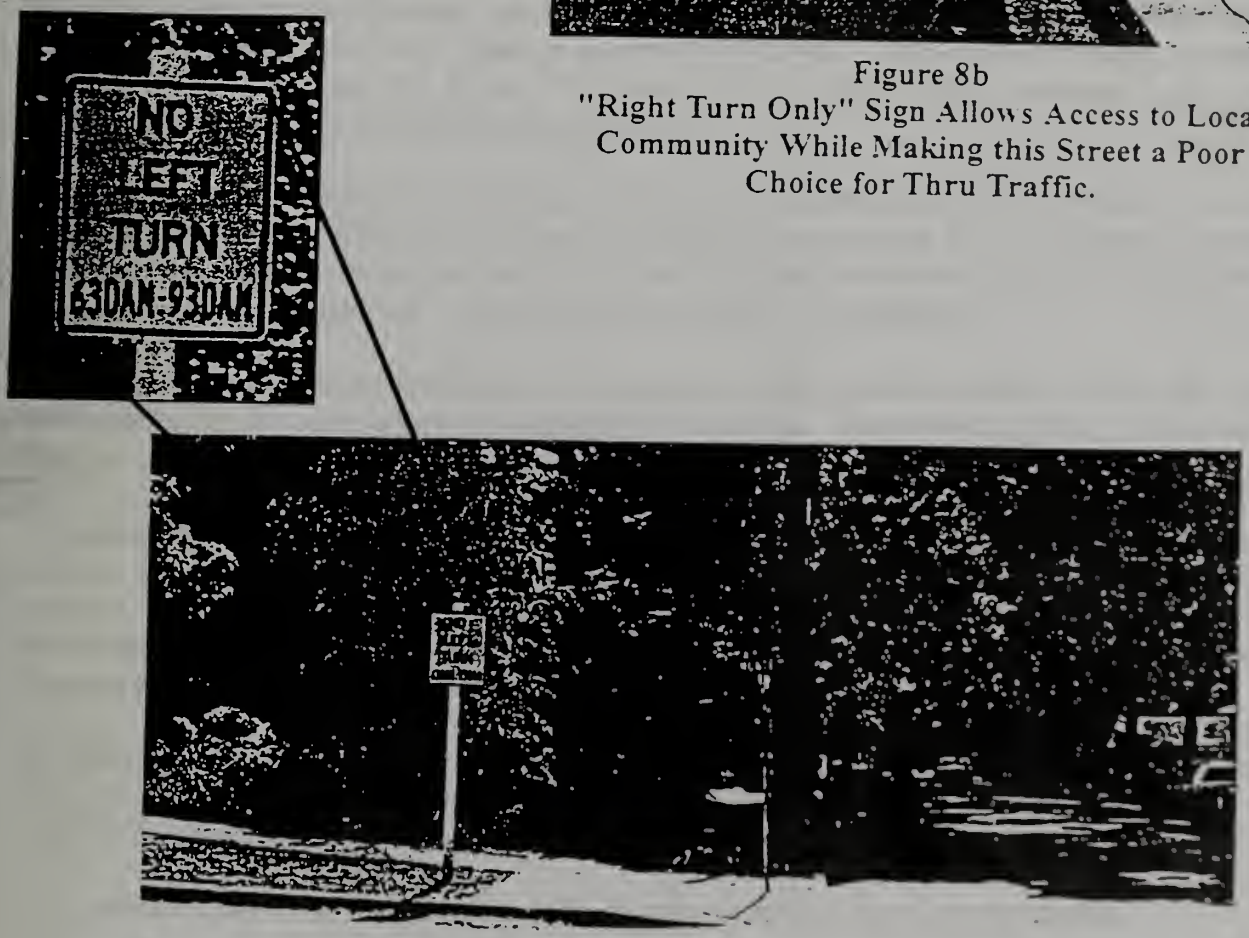



Figure 8c
Left Turn Prohabition Keeps Commuter Traffic on Main Streets by Eliminating Short-Cuts Through Quiet Local Neighboorhood Streets. After Rush-Hour, This Control Yields for the Convienence of Local Traffic.

## CUL-DE-SAC

*Description:* Located at intersection limits or at midblock. Using curb, gutter, sidewalk, bollards and/or other design features, revises a block with a through traffic pattern to create a block which has traffic ingress and egress at only one end, or at both ends but with through travel eliminated. Creates a situation similar to streets sometimes provided in new subdivisions which have ingress/egress at one end only.

*Objective:* Reduce traffic volume.

*Neighborhood Traffic Applications:* Used on local access streets with significant through traffic volume. Normally used at intersections except on streets where transitions between residential and other land uses suggest a midblock location.

*Prerequisites, Limitations & Constraints:* Used only on local access streets; unacceptable on collectors and arterials. Not acceptable across public transit routes.

Requires adequate sight distance and reasonable grade conditions. Parking restrictions usually necessary to create turn-around space at interior(s) of device. Turn-around situation extremely difficult if used with less than 36-foot curb-to-curb width. May require widening in turn area. Prototype designs require site-specific customization.

Used singly or in combination with other devices in neighborhood diversion system. Normally requires assessment of effects in broad area circulation context, even if not intended as part of a neighborhood system. Applicable only if effects of diverted traffic are regarded as acceptable. Reasonable access to "internal" properties and streets must be maintained.

May require reconstruction/relocation of manholes, utility valves, drainage inlets and street monumentation and construction of additional fire hydrants. Requires emergency vehicle access features on key emergency service routes.

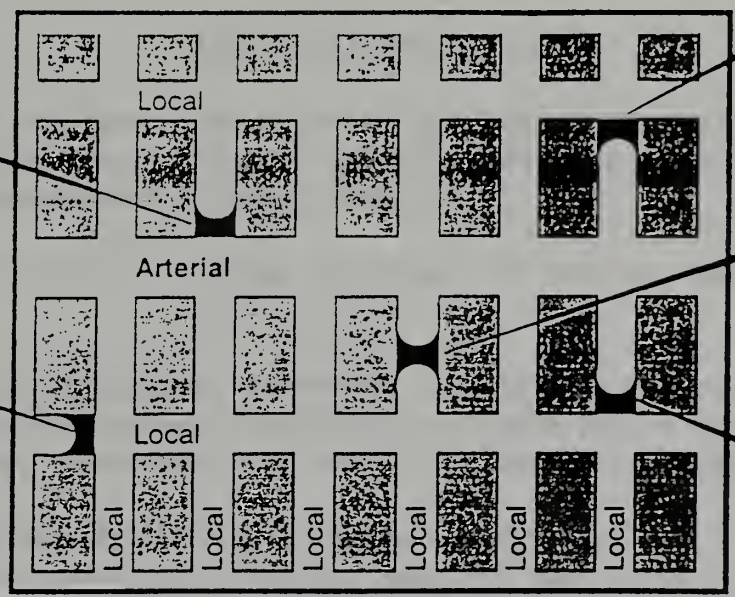
*Advantages/Other Considerations:* Potential significant adverse effects on regularly routed services (i.e. refuse collection, school transit) and inconvenience to irregular services (i.e. parcel delivery, moving vans), especially because the turning circle routinely incorporated at the end of cul-de-sacs built in new subdivisions can rarely be developed in the retrofit ones. Effects on bicycles and bikeways can be mitigated by design features.

Provides opportunity to create crossingless pedestrian paths to schools, parks and community facilities as well as landscape opportunity. Objective with landscape is to create appearance that street traffic way never went through cul-de-sac area.

*Alternate Devices:* Diagonal diverters, semi-diverters, median islands, channelization.

*Cost (Typical):* $10,000 in hardscape - $15,000 per installation in landscape (cost can vary significantly as result of site conditions).

# Cul-De-Sac




With cul-de-sac at peripheral location, outside traffic is barred rather than trapped.

With cul-de-sac at internal location, outside traffic will wander into the neighborhood and be trapped.

Cul-de-sac at midblock may surprise vehicles from both directions. Midblock treatments. best used only at land use transition points.

Cul-de-sac on short block minimizes backing difficulties of large vehicles.

Cul-de-sac on long block creates difficulties for large vehicles which may have to back out.

Figure 9a - Cul-De-Sac Location Implications.

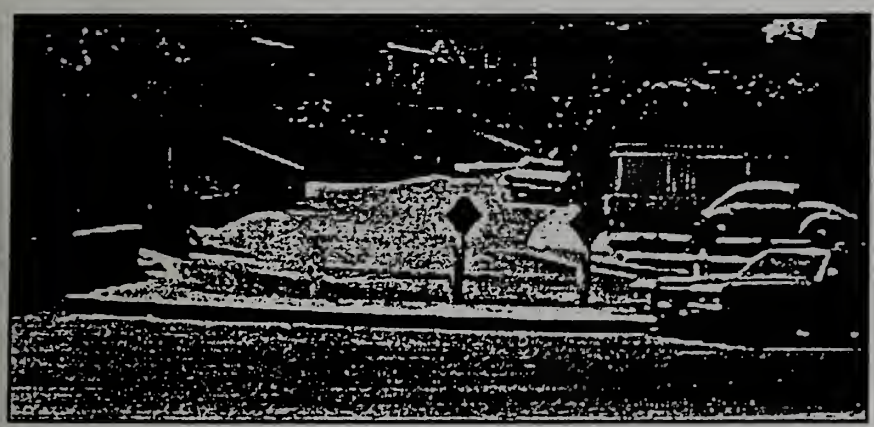


Figure 9b - Hardscaped Cul-De-Sac.

Figure 9c - Landscaped Cul-De-Sac.

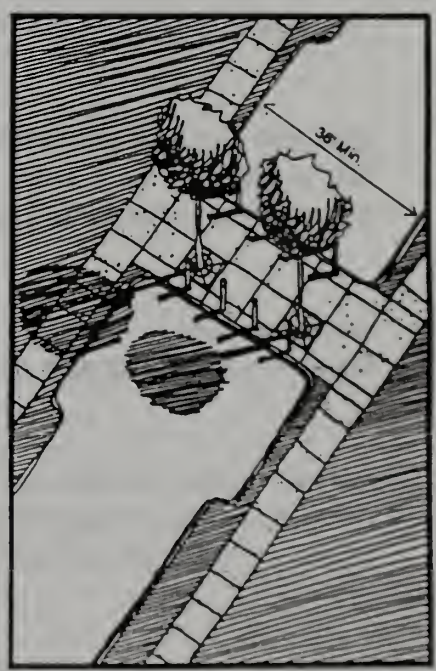



Figure 9d - On Narrow Streets Cul-De-Sac May Necessitate Parking Restriction and or Spot Widening for Adequate Turning.

## DIAGONAL DIVERTERS

*Description:* Uses curb, gutter, sidewalk, centerline striping, signs, markings and other design features to convert two streets intersecting at generally right angles into two unconnected streets, each making a right angle turn at the former intersection.

*Objective:* Reduce traffic by creating less direct and less convenient routings through neighborhoods.

*Neighborhood Traffic Applications:* Placed on local access streets experiencing significant through traffic burdens, where some physical restraint of traffic paths is acceptable and desirable, and where the more rigorous restraint of cul-de-sacs is undesired or unacceptable.

*Prerequisites, Limitations & Constraints:* May be placed only on local access streets with not more than two lanes. Intersecting streets both must be at least 30 feet in curbface-to-curbface width to allow adequate space for development of the diverter and the travel lanes. Not acceptable across public transit routes.

Requires adequate sight distance and reasonable grade conditions. Prototype designs require site-specific customization.

Used singly or in combination with other devices in neighborhood diversion system. Normally requires assessment of their effects in broad area circulation context, even if not intended as part of a neighborhood system. Effects of diverted traffic must be regarded as acceptable; reasonable access to "internal" properties and streets must be maintained.

May require reconstruction/relocation of manholes, utility valves, drainage inlets and street monumentation and construction of additional fire hydrants. Requires emergency vehicle access features on key emergency service routes.

*Advantages/Other Considerations:* Less significant adverse effects on regularly routed services (i.e. refuse collection, school transit) and inconvenience to irregular services (i.e. parcel delivery, moving vans) than cul-de-sacs. Effects on bicycles and bikeways can be mitigated by design features.

Creates opportunity to create crossingless pedestrian paths to schools, parks and community facilities as well as landscape opportunity. Objective with landscape is to create appearance that streets never actually intersected in the original pattern.

*Alternate Devices:* Cul-de-sac, semi-diverter, median island, channelization, turn prohibitions.

*Cost (Typical):* $10,000 hardscaped; $15,000 landscaped.

# Diagonal Diverters

Figure 10a
Diagonal Diverters Change Two Crossing Streets Into Two Unconnected Streets, Each Making a Right-Angle Turn.

**Figure 10b1**
**Landscape Diverter: Ultimate Objective of Landscape is to Create Apppearance Streets Never Connected.**

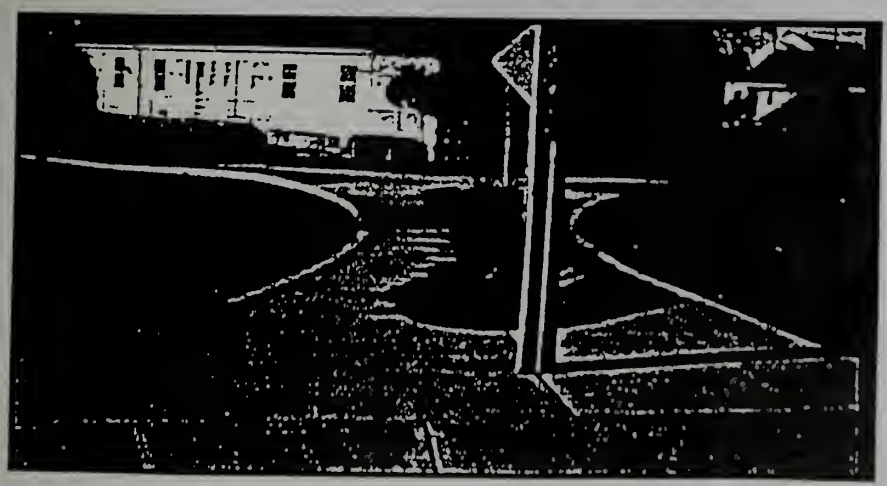


**Figure 10b2**
**Hardscapped Diverters: Can be moderate cost curb, gutter, sidwalk like illustration or low cost bollard construction.**

**Figure 10b**
**View illustrates How Diagonal Diverter & Cul-De-Sac Can be Used to Create Safe Pedestrian Paths Across Streets in Neighbohoods to Key Destinations Such as Parks & Schools.**

## SEMI-DIVERTERS

***Description:*** Use of curb, gutter, possibly landscape and other features (or use of raised bars or bollards in substitute for curb and gutter) to convert a street block formerly accessed at both ends to a two-way street with egress at both ends but with ingress at only one end.

***Objective:*** Reduce traffic volume; reduce particular patterns of through traffic.

***Neighborhood Traffic Applications:*** Used on local access streets in situations where there is desire to reduce traffic but with less rigorous effect than imposed by cul-de-sacs and diagonal diverters or where the desire is to affect a specific pattern of through traffic. Often used in combination with other devices in a neighborhood system.

***Prerequisites, Limitations & Constraints:*** Used only on local access streets. Normally positioned to limit ingress rather than egress, since egress restraint traps the unwitting motorist, leading to difficult turn-around maneuvers, driver resentment and frequent avoidance violations. Best placed to control access at arterial boundaries to neighborhoods since placements at secluded locations within neighborhoods are subject to higher rates of violation. Requires adequate sight distance, absence of severe grade or awkward geometric conditions. May require relocation or adjustment of drainage, manholes, utility valves or street monumentation.

***Advantages/Other Considerations:*** Can be used effectively where emergency vehicle route considerations limit application of other devices. Effective on narrow streets where other devices are problematic.

***Alternate Devices:*** Diagonal diverter, cul-de-sac, median island, turn prohibitions, channelization.

***Cost (Typical):*** $4,000 hardscaped; $6,000 landscaped.

# Semi-Diverter

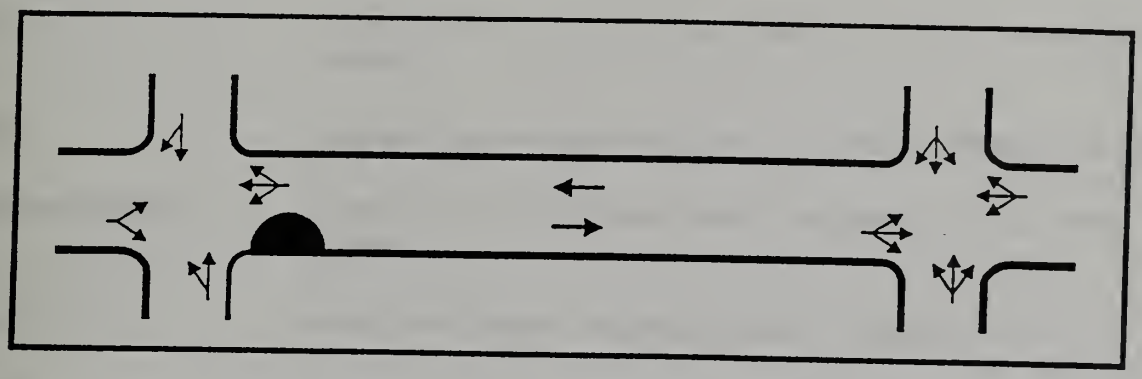


Figure 11a
Semi-Diverter Creates a 2-Way Block
Which Can be Entered From Only One End.

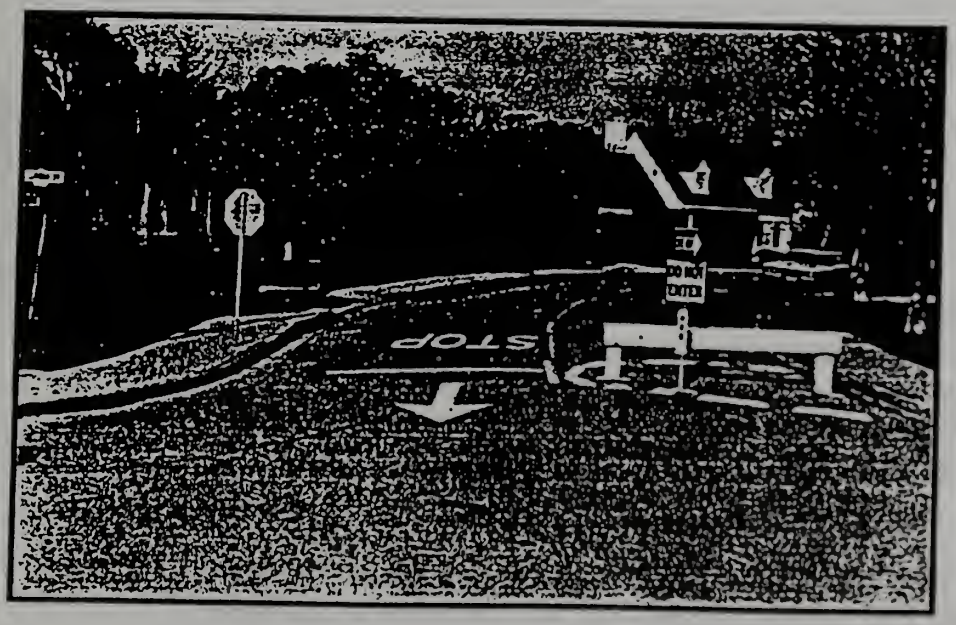



Figure 11b
Although Landscape is Possible, Semi-Diverters
are Most Often Constructed in Hardscape.

## GLOSSARY

| | |
|---|---|
| access | ability to enter and exit a property, a street, or a neighborhood; includes both ingress and egress (see below) |
| chicane | artificial sinuousness or curvature added to an otherwise straight roadway |
| chord | a straight line connecting two points on the circumference of a circle |
| crest vertical curve | a vertical curve which forms a crest, as opposed to a sag, in the roadway |
| egress | ability to exit from a property, a street, or a neighborhood |
| grade | a vertical incline; can be either uphill or downhill |
| hardscape installations | the use of concrete, asphalt, and other such "hard" materials to create the features of a traffic control device; little or no landscaping is included in the installation |
| horizontal alignment | the variation of a roadway's route in the left/right directions |
| ingress | ability to enter into a property, a street, or a neighborhood |
| landscape installations | the use of soil, ground cover, shrubbery, trees, and other such "soft" materials to create the features of a traffic control device |
| midblock | any point between successive intersections along a street |
| percentile | a technique for grouping and ranking speeds on a street using percentages; the 85th percentile is typically used to identify the maximum reasonable speed for setting speed limits; the presumption is that the speed at or below which 85 percent of the traffic is moving on a given street is an indication of the reasonable and safe speed for the street |
| portal | a feature framing and marking an entry point; in this application, the transition from arterial/collector streets and intense land uses of the urban environment to local access streets and residential land uses; the feature may be columns, a gate frame, or landscaping suggesting a gateway |

| | |
|---|---|
| prototype designs | typical designs indicating basic features and materials and suggesting aspects of construction methods; prototype designs usually need to be adjusted to conform to the conditions and constraints at each application site |
| right of way | 1) the right to proceed into an intersection when vehicles are present on more than one approach to the intersection; 2) the area between property lines on either side of a public street, as in *the public right of way*; includes sidewalks, landscape areas, utility easements, and street areas |
| sight distance | the maximum distance at which a driver can clearly see an on-coming vehicle, a stopped vehicle, or an obstacle in the roadway; this distance is often reduced by the vertical and horizontal alignment of a roadway |
| street classification | the function which the street is intended to serve within the City's circulation system; typically streets are classified as arterials, collector streets, and local streets; the City's circulation element of the general plan typically provides this classification |
| street monumentation | permanent or semi-permanent markers placed to indicate right-of-way and property lines, elevations, utility locations, and similar information; also, raised pavement markings used to demarcate fire hydrants, centerlines, and other alignment features. |
| urban design features | urban amenity aspects separate from, but usually integral with, landscape which are often incorporated into the design of neighborhood traffic management devices; can include urban art, benches, bus-waiting shelters, mini-park features, or artistic configuration of landscape features |
| vertical alignment | the variation of a roadway's route in the up/down directions |

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| | |
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# APPENDIX B

# TRANSPORTATION

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## Introduction

A sustainable transportation system is one in which people's needs and desires for access to jobs, commerce, recreation, culture and home are accommodated using a minimum of resources. Applying principles of sustainability to transportation will reduce pollution generated by gasoline-powered engines, noise, traffic congestion, land devaluation, urban sprawl, economic segregation, and injury to drivers, pedestrians and cyclists. In addition, the costs of commuting, shipping, housing and goods will be reduced.

Ultimately in a sustainable San Francisco, almost all trips to and within the City will be on public transit, foot or bicycle—as will a good part of trips to the larger Bay Region. Walking through streets designed for pedestrians and bicycles will be more pleasant than walking through those designed for the automobile. Street-front retail and commercial establishments will prosper from the large volume of foot traffic drawn to an environment enhanced by trees, appropriately designed "street furniture," (street lights, bicycle racks, benches, and the like) and other people. Rents and property costs will be lowered as land for off-street parking is no longer required or needed. Customers will be closer to businesses; goods and services will be delivered more quickly; and time that employees would otherwise spend commuting will be available for activities of their own choice. The high use of transit and other alternatives to the automobile will enable the city and state to forego expensive freeway construction, land acquisition and housing condemnation. Old, obsolete highway segments of the automobile era will be demolished, freeing up land to be used and developed to its greatest potential as the community sees fit. With abundant, cheap and versatile alternatives to the automobile, the sustainable city is truly a place of equal access and enhanced opportunity.

Realizing the ideal of a sustainable San Francisco is a political, physical and educational challenge. Many people consider owning and driving an automobile an essential need or right—the very cornerstone of this country's

economic base. They do not recognize that the tradition of subsidizing gasoline, parking and driving has taken its toll on their pocketbooks and on the tax revenues that could be spent in ways much more conducive to sustainability. Some people are willing to drive less, to pay higher tolls and parking fees, and to support investments in alternative transportation, but as a result, they expect transit and other infrastructure to adapt and respond more readily to their needs. The City needs more revenue today simply to maintain the existing level of transit operation and service—and much more to match such expectations.

Reallocating revenues and subsidies from the automobile to public transit and other alternative modes is essential to move toward sustainable transportation. In addition, issues such as land use, traditions, safety and comfort profoundly influence the way people move about. Listed below are goals, objectives and actions that, if implemented, will guide government officials, residents, community and business leaders toward a sustainable transportation system for San Francisco.

## Sustainability Strategy

| GOALS | LONG-TERM OBJECTIVES TO REACH SUSTAINABILITY | OBJECTIVES FOR THE YEAR 2002 (5-year plan) | ACTIONS |
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| . To move people and goods with the most efficient use of resources. | 1-A. 100% of trips into and within the City are accommodated by means other than single-occupancy vehicles.<br><br>1-B. All transit vehicles operating within the City are powered by renewable energy.<br><br>1-C. All goods are delivered by renewable energy vehicles. | 1-1. The number of trips (including all modes, such as pedestrian, bicycle and public transit trips) into and within the City has remained constant or increased. While producing less pollution and congestion, San Franciscans mobility has improved.<br><br>An increase in the total number of person-trips into and within the City will be accommodated while decreasing | 1-1-a. Establish a Metropolitan Transportation Commission advertising budget to increase public awareness of transit options.<br><br>1-1-b. Educate the public about the true cost of automobile use.<br><br>1-1-c. Double the total funds transferred from parking taxes to Muni transit by increasing the 25% parking tax in 5% increments every year as necessary.<br><br>1-1-d. Collect the maximum amount of parking taxes legally due the City from all parking lots.<br><br>1-1-e. Implement congestion pricing and increase bridge tolls during peak hours. Use funds for transit.<br><br>1-1-f. Increase bridge tolls. Use the |

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| | | the number of single-occupancy vehicles. | funds for seismic improvement of bridges and bridge approaches.<br><br>1-1-g. Eliminate free parking for government and private employees' private automobiles. Charge for parking at the same rate as nearby private parking lots. Charge for commuter parking on city streets and in parks.<br><br>1-1-h. Increase City gasoline taxes and lobby for increased regional gasoline taxes. Use the funds for transit.<br><br>1-1-i. Implement "parking cash-outs" which allow commuters to chose to receive cash instead of free parking. |
| | | | 1-1-j. Provide adequate maintenance to improve the appearance of transit vehicles.<br><br>1-1-k. Extend Proposition B, sales tax revenue for transportation, and increase the share for transit, bicycle and pedestrian improvements.<br><br>1-1-l. Establish firm funding for Muni operations and capital budgets, using downtown and residential transit assessment districts, a residential utility tax, and parking taxes and fees.<br><br>1-1-m. Lobby for an income-tax deduction for the cost of transit passes.<br><br>1-1-n. Require businesses that provide free parking for customers to provide an equal benefit for those who come by other modes. |

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| | | | 1-1-o. Assess environmental impacts on transportation systems using performance measures in addition to vehicles' "level of service." More sustainable measures include "person throughput," consideration of all methods of transportation, and accessibility.<br><br>1-1-p. Do not increase Muni fares.<br><br>1-1-q. Reduce the cost of Fast Passes.<br><br>1-1-r. Study the impacts of providing an expanded fareless Muni service. [See note 1, following the matrix.] |
| | | 1-3. Bicycle use has increased by 100%. | 1-3-a. Implement the Bicycle Plan, including a network of contoured bicycle-priority routes using protected space.<br><br>1-3-b. Educate bicyclists and motorists with signs and outreach about safe sharing of roadways.<br><br>1-3-c. Provide secure bicycle and roller-skate storage at transit stations.<br><br>1-3-d. Allow bicycles on all transit routes.<br><br>1-3-e. Provide a safe bicycle way through bus and corner bulbs if necessary as part of a bicycle lane.<br><br>1-3-f. Require and include incentives for businesses to provide secure parking and storage for bicycles and roller skates. |

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| | | | 1-3-g. Reimburse staff for mileage when errands are performed by bicycle.<br><br>1-3-h. Provide secure bicycle parking for recreational areas, such as beaches, parks, tourist attractions and commercial areas.<br><br>1-3-i. Encourage the development of bicycle service centers to key neighborhood and recreational sites.<br><br>1-3-j. Provide loaner bikes at key transit stations and centers. |
| | | 1-4. The number and enjoyment of trips made by walking has increased. [See note 2, following the matrix.] | 1-4-a. Widen sidewalks where required by pedestrian traffic demand. Provide a sidewalk width in all commercial areas to at least meet disabled access requirements.<br><br>Implement the pedestrian network:<br><br>1-4-b. Change traffic signals to allow pedestrians to cross at a walking pace of 2.5 feed per second.<br><br>1-4-c. Establish corner bulbs and median islands to provide a safe area for waiting for crossing signals and to shorten the time required to cross the roadway.<br><br>1-4-d. Remove sidewalk obstructions, such as newspaper racks. |
| | | | 1-4-e. Increase education and enforcement of "pooper scooper" laws. |

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| | | | 1-4-f. Beautify walkways with amenities such as:<br>• More trees;<br>• Outdoor eating areas;<br>• Signs and flags; and<br>• More attractive, pedestrian-oriented store-fronts.<br><br>1-4-g. Enforce laws against parking on sidewalks and blocking crosswalks.<br><br>1-4-h. Restore pedestrian crosswalks.<br><br>1-4-i. Add mid-block pedestrian crosswalks on long one-way streets and, where safe, on two-way streets.<br><br>1-4-j. Increase enforcement against running red lights with cameras and more police.<br><br>1-4-k. Complete the work of making sidewalks more accessible for disabled.<br><br>1-4-l. Update the use of flashing signal lights to provide additional safety and convenience for crossing pedestrians during periods of low automobile traffic.<br><br>1-4-m. Provide a *WALK* signal that allows sufficient time for a pedestrian to cross safety at every signaled intersection.<br><br>1-4-n. Permanently eliminate automobile traffic on the portions of Kennedy Drive, in Golden Gate Park, |

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| | | | that are currently closed only on Sundays.<br><br>1-4-o. Increase transit service to Golden Gate Park and Presidio National Park. |
| | | 1-5. Transit on-time performance has increased to 97%. | |
| | | 1-6. Travel time for transit has been reduced by 10%. | 1-6-a. Decrease Muni trip times by:<br>• Constructing bus bulbs which allow buses to pick up passengers without leaving the traffic lane;<br>• Adding transit preferential streets;<br>• Using timed transfers; and<br>• Providing and using signal preempts.<br><br>1-6-b. Increase distances between transit stops.<br><br>1-6-c. Increase the use of improved transit technology.<br><br>1-6-e. Improve feeders service to trunk lines.<br><br>1-6-f. Make transfers physically quicker and easier.<br><br>1-6-g. Improve feeder service to trunk lines.<br><br>1-6-h. Implement a proof-of-payment fare system to allow passengers to use |

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| | | | all doors on transit.<br><br>1-6-i. Decrease BART dwell-time at stations.<br><br>1-6-j. Electrify CalTrain.<br><br>1-6-k. Build grade separations for CalTrain. |
| | | 1-7. The efficiency of goods movement has improved, reducing delivery time by 10%. | 1-7-a. Increase the number and size of yellow and metered yellow curbs.<br><br>1-7-b. Increase yellow curb enforcement.<br><br>1-7-c. Develop a comprehensive truck route system that gives trucks priority over automobiles.<br><br>1-7-d. Set goods delivery times to off-peak hours on transit streets.<br><br>1-7-e. Establish goods-delivery times downtown that give trucks priority over automobiles. |
| 2. To have convenient regional transportation connections. | 2-A. All regional transit connections are safe, comfortable, convenient and timely. | 2-1. All regional transit connections are safe, comfortable, convenient and timely. | 2-1-a. Provide a same-level transfer between BART and Muni Metro (not up to the mezzanine and back down).<br><br>2-1-b. Provide convenient connections to the San Francisco Airport from BART and CalTrain.<br><br>2-1-c. Extend CalTrain to downtown San Francisco.<br><br>2-1-d. Support the study and planning for high-speed rail between Los Angeles and San Francisco. |

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| | | | 2-1-e. Provide convenient transfers to transit for special events and publicize and market these connections.<br><br>2-1-f. [See also 1-3-c and d.] |
| | | 2-2. Agreement has been achieved from nine counties on improving regional connections through an integrated, public-transit-oriented regional transportation plan. | 2-2-a. Implement a one-ticket-around-the-Bay system, such as Translink.<br><br>2-2-b. Create a public/private lobby for Bay-region transportation. |
| 3. To integrate transportation, land use, and economic development policies. | 3-A. All trips in the City can be made by walking, bicycling and transit; the city is so beautiful and clean that such trips are a joy. | 3-1. Building and planning codes have been revised to help implement sustainable transportation objectives. | 3-1-a. Re-evaluate garage and parking requirements in the Code, city-wide, to establish maximum, rather than minimum, levels of required parking.<br><br>3-1-b. Reduce or eliminate planning code parking requirements for some housing types, as appropriate, such as:<br><br>• Low-income residences,<br><br>• Residences with limited access due to space constraints,<br><br>• Low-vehicle-ownership residences,<br><br>• Buildings located near transit, and<br><br>• Buildings in which tenants and owners agree not to obtain parking permits. |

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| | | | 3-1-c. Secure strong pedestrian links from transit centers to key destinations.<br><br>3-1-d. Require bicycle facilities as part of all new development. |
| | | 3-2. Sustainability criteria have been incorporated into transportation and land use planning. | 3-2-a. Revise policies, objectives and regulations in codes and city plans.<br><br>3-2-b. Repeal the service station conservation ordinance.<br><br>3-2-c. Do not allow the construction of new publicly subsidized parking garages.<br><br>3-2-d. Revise the planning code to allow more commercial and recreational facilities closer to residential areas. |
| 4. To reduce transportation energy consumption and pollution generation. | 4-A. Non-polluting, renewable-energy-powered vehicles are used for all trips into and within the City. | 4-1. Transportation-related non-renewable fuel consumption has been reduced by 10%.<br><br>4-2. Automobile vehicle-miles traveled have been reduced by 5%. | 4-1 & 2, [See actions 1-1-a. through 1-1-r.] |
| | | 4-3. Fuel efficiency of vehicles in San Francisco has improved. | 4-3-a. Purchase only high-fuel-efficient vehicles for the City fleet.<br><br>4-3-b. Lobby for State legislation providing incentives for fuel-efficient vehicles. |

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| | | 4-4. 10% of all light-duty vehicles purchased are zero-emission vehicles (including bicycles). | 4-4-a. Work with automobile manufacturers to attract the early introduction of zero-emission vehicles to San Francisco.<br><br>4-4-b. Provide three public electric-energy refueling facilities for vehicles. |
| | | 4-5. Optimal use of present transportation systems has increased. | 4-5-a. Increase the use of computers to handle the complexities of service scheduling, vehicle maintenance, and the optimization of signal timing.<br><br>4-5-b. Provide on-demand transit service on established routes during off-off peak hours, including custom stops and pickups.<br><br>4-5-c. Use smaller buses or vans during off-off peak hours on routes with low patronage. |
| 5. To reduce dependence on automobiles. | 5-A. 90% of all San Francisco trips, including at least 90% of commute trips downtown, are made by means other than the private automobile.<br><br>5-B. 100% of all San Francisco-generated automobile trips are made in renewable-energy-powered vehicles.<br><br>5-C. "Traffic calming" projects on a majority of city streets have been implemented. | 5-1. 85% of commuter trips to the downtown and 45% elsewhere are made by means other than a drive-alone private automobile.<br><br>Non-commute generated automobile trips have been reduced by 5%. | 5-1-a. Create shuttle services from existing garages to key outlying destinations.<br><br>5-1-b. Create a weekend and holiday Golden Gate Park and Museum shuttle from nearby garages and transit.<br><br>5-1-c. Provide incentives for businesses that provide commuter vans for employees.<br><br>5-1-d. Study the effects of eliminating private through-traffic on Market Street and the methods of implementing such a plan.<br><br>5-1-e. Study the effects of eliminating automobile traffic from small lengths of |

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| | 5-D. Market Street is closed to private automobiles east of Van Ness Avenue.<br><br>5-E. A number of sections of streets have been closed to private automobiles. | | other streets in addition to Market Street.<br><br>5-1-f. Provide package storage lockers in transit stations and transit centers.<br><br>5-1-g. Provide access through doors and elevators in space on vehicles for baby carriages and large packages.<br><br>5-1-h. Use teleconferencing to reduce long-distance travel, and home businesses and telecommuting to reduce local travel.<br>(*Suggested for business and government*)<br><br>5-1-i. Develop additional delivery services.<br>(*Suggested for the private sector*)<br><br>5-1-j. Advertise and promote transit use as a means of avoiding and not contributing to traffic congestion.<br><br>5-1-k. [See Actions 1-1-a through 1-1-r.] |
| ;. To increase the eality and perception f safety and civility n transit to all. | | 6-1. The quality of Muni service has improved. | 6-1-a. Train transit operators to provide courteous service, including at least:<br>• Calling out stops,<br>• Careful driving and<br>• Giving tourist information.<br><br>6-1-b. Educate transit riders on how to use transit with courtesy and efficiency.<br><br>6-1-c. Enforce the laws on transit and at stops with a greater presence of |

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| | | | authority figures.<br><br>6-1-d. Improve design and maintenance to make transit vehicles and stations more pleasant.<br><br>6-1-e. Reduce the incidence of overcrowding on transit vehicles.<br><br>6-1-f. Improve working conditions for transit operators to reduce mental and physical stress.<br><br>6-1-g. Increase reference in advertising to the use of transit. (*Suggested for private advertisers*)<br><br>6-1-h. Provide an Internet website to provide information on transit, bicycles, and other alternatives to single-occupancy vehicles.<br><br>6-1-i. Provide better maps and signs to help riders use transit service.<br><br>6-1-j. Use enhanced and innovative technology to give information on current transit status, orientation and use of service, especially at key transit stops. |
| | | 6-2. Pedestrian and bicyclist safety and pleasure have increased. | 6-2-a. Educate drivers, pedestrians and bicyclists about the rules and courtesies of sharing streets.<br><br>6-2-b. Provide signs on streets reminding drivers to share the streets. |
| | | 6-3. Accident rates for all transportation | 6-3-a. Enforce traffic laws more stringently, especially at high-accident- |